(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号
特開2000－68416
（P2000－68416A）
(43)公開日　平成12年３月３日(2000.3.3)

| (51)Int.Cl.' | 識別記号 | ＦＩ | | テーマコード'（参考） |
|---|---|---|---|---|
| Ｈ０１Ｌ　23/28 | | Ｈ０１Ｌ　23/28 | Ｔ | ４Ｆ２０６ |
| Ｂ２９Ｃ　45/14 | | Ｂ２９Ｃ　45/14 | | ４Ｍ１０９ |
| 45/60 | | 45/60 | | |
| // Ｂ２９Ｌ　31:34 | | | | |

審査請求　未請求　請求項の数４　ＯＬ　（全８頁）

(21)出願番号　特願平10－234214

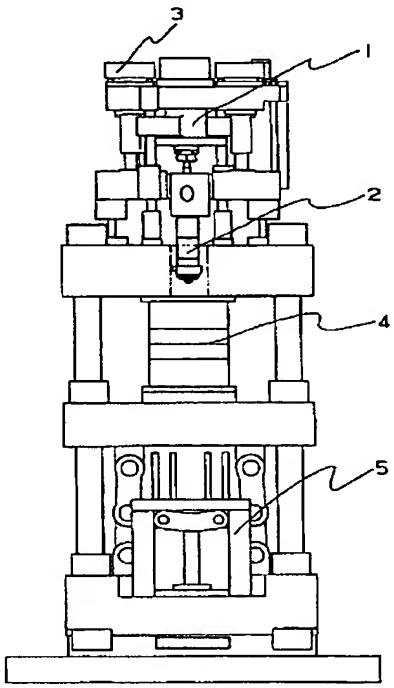
(22)出願日　平成10年８月20日(1998.8.20)

(71)出願人　000002141
住友ベークライト株式会社
東京都品川区東品川２丁目５番８号
(71)出願人　000003931
株式会社新潟鉄工所
東京都大田区蒲田本町一丁目10番１号
(72)発明者　伊藤　英雄
東京都品川区東品川２丁目５番８号　住友ベークライト株式会社内
(74)代理人　100075351
弁理士　内山　充

最終頁に続く

(54)【発明の名称】　半導体封止成形方法及び装置

(57)【要約】
【課題】成形サイクルが短く、硬化廃棄物の量が少なく、硬化した封止材料中の微小ボイドが少ない半導体封止成形方法、及び、該成形方法の実施に有用であり、全高が低く在来のクリーンルーム内への設置が容易な半導体封止成形装置を提供する。
【解決手段】半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして固定し、これをエポキシ樹脂封止材料にて封止する成形方法において、射出ユニットに、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、スクリュー又はプランジャでキャビティ内に射出し、射出された前記封止材料を硬化させることにより半導体を封止する半導体封止成形方法であって、射出ユニットとして、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であるスクリューを使用することを特徴とする半導体封止成形方法、及び、半導体封止成形装置。



1

【特許請求の範囲】

【請求項１】半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして固定し、これをエポキシ樹脂封止材料にて封止する成形方法において、射出ユニットに、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、スクリュー又はプランジャでキャビティ内に射出し、射出された前記封止材料を硬化させることにより半導体を封止する半導体封止成形方法であって、射出ユニットとして、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であるスクリューを使用することを特徴とする半導体封止成形方法。

【請求項２】半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして固定し、これをエポキシ樹脂封止材料にて封止する成形装置において、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、スクリュー又はプランジャでキャビティ内に射出する射出ユニットを有し、射出された前記封止材料を硬化させることにより半導体を封止する半導体封止成形装置であって、射出ユニット内のスクリューが、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であることを特徴とする半導体封止成形装置。

【請求項３】スクリュー有効長Ｌが２５０～４００㎜である請求項２記載の半導体封止成形装置。

【請求項４】射出ユニット内の材料投入部において、投入口及び流入部の表面粗さがいずれも０．４０～６．３μｍＲａであり、かつ投入口と流入部の接続部に段差がない形状である請求項２記載の半導体封止成形装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、半導体封止成形方法及び装置に関する。さらに詳しくは、本発明は、成形サイクルが短く生産性に優れ、硬化廃棄物の量が少なく、硬化したエポキシ樹脂封止材料中の微小ボイドが少ない半導体封止成形方法、及び、該成形方法の実施に有用であり、しかも全高が低く在来のクリーンルーム内への設置が容易な半導体封止成形装置に関する。

【０００２】

【従来の技術】ＩＣ、ＬＳＩ、ディスクリート等の半導体の封止には、従来よりエポキシ樹脂封止材料のトランスファ成形が、低コスト、高信頼性及び生産性に適した方法として用いられている。トランスファ成形では、エポキシ樹脂封止材料をタブレット状に賦形してから、金型内のポットに投入し、加熱溶融させながらプランジャで加圧することにより、金型キャビティ内に移送し、硬化させる。

【０００３】しかしながら、この成形方法では、エポキシ樹脂封止材料をタブレット状に賦形することが前提となるために、賦形の工程が必要である。成形される半導体パッケージの形状・大きさにより必要なタブレットの形状は種々異なるので、賦形のための金型も多数必要である。また、成形毎にタブレットの投入と熱溶融が必要であるために、成形サイクルを一定時間以下に短縮できない。更に、ポットに投入されたエポキシ樹脂封止材料が、金型内を流動してキャビティ内に到達する迄の流路であるランナー部や、ポット内で残りのカル部が完全に硬化してしまうために、必要とする半導体パッケージ部以外に多量の硬化廃棄物が発生する等の問題があり、これらの点から低コスト化、大量生産性に限界がある。

2

【０００４】一方、エポキシ樹脂を含む熱硬化性樹脂成形材料の成形方法として、射出成形システムの検討が従来より行われてきた。射出成形においては、エポキシ樹脂成形材料は、射出成形機内に粉末状又は顆粒状にて供給され、シリンダー内で溶融状態を保ったままスクリューにより金型に射出される。このため、タブレット状に賦形する工程が不要であり、賦形のための装置・時間を省略することができる。また、溶融状態で射出するために、トランスファ成形のようにタブレット径及び重量の制約がなく、種々の半導体パッケージに容易に適用することができる。更に、連続生産が可能であり、均一溶融状態となり低粘度化した成形材料が金型に射出されるために、硬化時間がトランスファ成形に比べ短縮され、流路であるランナー部やスプルー部を少なくすることができる等、大量生産に適した方法である。

【０００５】しかしながら、従来エポキシ樹脂封止材料の成形方法として、射出成形は実用化されていなかった。その理由としては、従来のエポキシ樹脂封止材料は、７０～１１０℃に加熱されたシリンダー内での溶融状態では、エポキシ樹脂封止材料中の樹脂の硬化反応の進行によって粘度が増大し、５～１０分間で流動性を失う性質を有しており、溶融したエポキシ樹脂封止材料の熱安定性が著しく低いためである。このために、低圧での射出成形は不可能であり、高圧での射出成形を必要とし、その結果半導体上のボンディングワイヤの変形や切断、あるいはダイオード等では内部素子への加圧による電気性能の低下等、得られる半導体パッケージの信頼性を著しく損なう結果となった。また、金型の掃除等のために成形を一定時間中断する場合には、エポキシ樹脂封止材料はシリンダー内で硬化し、再度の射出が不可能となるために、連続生産にも支障をきたしてしまうという問題もあった。

【０００６】熱硬化性樹脂射出成形機の射出ユニット内のスクリュー形状は、各成形機メーカーにより種々異なるが、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）は、均一な可塑化溶融、シリンダーの温調ゾーンの構成と長さのバランス、計量ストローク等の関係より、一般的にはＬ／Ｄ＝１４～１８である。このために、材料をキャビティ内に射出して硬化させる金型、その金型

を開閉する型締め機構を含んだ装置全体の寸法は、竪型締め・竪射出の全高として３，０００㎜を超えるのが普通である。竪射出の場合、成形メーカーの天井高さは２階まで吹き抜けの場合が多い。しかしながら、半導体成形の場合は、半導体の保護の観点から環境が重視され、恒温・恒湿・クリーン化が求められるので、全室クリーンルームとなっている。そのために、成形装置の設置スペースには制約があり、トランスファ成形装置の全高は全て３，０００㎜以下となっている。射出成形装置の場合は、特に射出ユニットの長さにより成形装置の全高が高くなり、クリーンルーム内に設置できないという問題が生じていた。

【０００７】封止材料投入から射出までの射出ユニットの構成は、一般的な熱硬化性樹脂の場合、シリンダ及び水冷回路を有するシリンダ取り付け部に区分されている。シリンダ取り付け部の材質は鋳物が多く、単純な機械加工を行った材料投入口の表面粗さは、通常５０～１００μｍRaであり、仕上げ加工を行っても１２．５～２５μｍRaである。シリンダの材質は熱処理された特殊鋼材が多く、シリンダに設けられた材料流入部の表面粗さは３．２～２５μｍRaである。また、投入口と流入部の接続部には、段差が生じている場合が多い。このような表面粗さでかつ組立時に段差が生じていると、熱可塑性樹脂のペレット状成形コンパウンドの場合は材料投入箇所での流動性に問題は発生しにくいが、粉末状又は顆粒状で供給されるエポキシ樹脂封止材料の場合は流動性が悪く、投入口及び流入部でブリッジが発生し、計量バラツキや、ひいては材料が供給されない等の問題が発生しやすい。

【０００８】

【発明が解決しようとする課題】本発明は、成形サイクルが短く生産性に優れ、硬化廃棄物の量が少なく、硬化したエポキシ樹脂封止材料中の微小ボイドが少ない半導体封止成形方法、及び、該成形方法の実施に有用であり、しかも全高が低く在来のクリーンルーム内への設置が容易な半導体封止成形装置を提供することを目的としてなされたものである。

【０００９】

【課題を解決するための手段】本発明者らは、上記の課題を解決すべく鋭意研究を重ねた結果、射出ユニットとしてスクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であるスクリューを使用することにより、粉末状又は顆粒状のエポキシ樹脂封止材料による封止成形を円滑に行うことができ、さらに、スクリュー有効長を２５０～４００㎜とし、射出ユニット内の材料投入口及び流入部の表面粗さを０．４０～６．３μｍRaとし、投入口と流入部の接続部分に段差のない形状とすることにより、一層効率的に封止成形を行い得ることを見いだし、この知見に基づいて本発明を完成するに至った。即ち、本発明は、（１）半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして固定し、これをエポキシ樹脂封止材料にて封止する成形方法において、射出ユニットに、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、スクリュー又はプランジャでキャビティ内に射出し、射出された前記封止材料を硬化させることにより半導体を封止する半導体封止成形方法であって、射出ユニットとして、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であるスクリューを使用することを特徴とする半導体封止成形方法、（２）半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして固定し、これをエポキシ樹脂封止材料にて封止する成形装置において、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、スクリュー又はプランジャでキャビティ内に射出する射出ユニットを有し、射出された前記封止材料を硬化させることにより半導体を封止する半導体封止成形装置であって、射出ユニット内のスクリューが、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であることを特徴とする半導体封止成形装置、（３）スクリュー有効長Ｌが２５０～４００㎜である第(２)項記載の半導体封止成形装置、及び、（４）射出ユニット内の材料投入部において、投入口及び流入部の表面粗さがいずれも０．４０～６．３μｍRaであり、かつ投入口と流入部の接続部に段差がない形状である第(２)項記載の半導体封止成形装置、を提供するものである。

【００１０】

【発明の実施の形態】本発明の半導体封止成形方法は、半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして固定し、これをエポキシ樹脂封止材料にて封止する成形方法において、射出ユニットに、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、スクリュー又はプランジャでキャビティ内に射出し、射出された前記封止材料を硬化させることにより半導体を封止する半導体封止成形方法であって、射出ユニットとして、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であるスクリューを使用するものである。本発明の半導体封止成形装置は、半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして固定し、これをエポキシ樹脂封止材料にて封止する成形装置において、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、スクリュー又はプランジャでキャビティ内に射出する射出ユニットを有し、射出された前記封止材料を硬化させることにより半導体を封止する半導体封止成形装置であって、射出ユニット内のスクリューが、スクリュー有効

長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であるものである。

【００１１】図１は、本発明の半導体封止成形装置の一態様の概略正面図であり、図２は、その成形要部の概略平面図であり、図３は、その射出ユニットの要部断面図である。図１に示す態様の半導体封止成形装置は、半導体が接合され、ワイヤボンディングされたリードフレームを封止する成形装置であり、射出ユニット１、スクリューコンプリート２、駆動部３、成形金型４及び型締めユニット５を有する。図１及び図２に示されるように、その成形要部は、半導体が接合され、ワイヤボンディングされたリードフレームを収納し、次工程へ移送するインマガジン６、移送されたリードフレームを整列・金型へ搬送するフレームシュータ７、粉末状又は顆粒状で供給されるエポキシ樹脂封止材料を混練・溶融しキャビティ内に射出する射出ユニット１、リードフレームをインサートとして半導体を封止成形する成形金型４、成形金型を開閉する型締めユニット５、成形金型のキャビティ表面をクリーニングするクリーニングユニット８、成形されたリードフレームとランナー・ゲートを分離するゲートブレイク９、成形されたリードフレームを搬送・集積するアウトカセット１０で構成されている。半導体が接合されたリード線を封止する成形装置も、図１に示す成形装置と実質的に同じである。

【００１２】本発明装置において、射出ユニット１のスクリューコンプリート２は、図３に示すような構成を有する。即ち、シリンダ１１、ネジで連結されるノズルチップ１２、シリンダの温調を行う温調ジャケット１３、エポキシ樹脂封止材料の移送・混練・溶融を行うスクリュー１４、水冷回路を有するシリンダ取り付け部１５を有し、シリンダ取り付け部には材料投入口１６、シリンダには材料流入部１７が形成されている。粉末状又は顆粒状のエポキシ樹脂封止材料は、材料投入口１６から投入され、材料流入部１７を経由して、シリンダ１１内に供給される。スクリュー１４は、回転しながら後退し所定量の材料計量を行い、材料を前方へ移送する。このとき、スクリュー回転による内部摩擦熱及び温調ジャケット１３からの外部加熱により、エポキシ樹脂封止材料は、可塑化混練・溶融圧縮されながら前方へ移送され、低粘度化された状態で、ノズルチップ１２に蓄積される。その後、スクリュー１４の前進によってキャビティ内に射出され、所定の硬化時間を経たのち、型開き・突き出しすることにより、半導体の封止成形を完了する。

【００１３】本発明方法において使用するエポキシ樹脂封止材料は、エポキシ樹脂、フェノール樹脂系硬化剤、硬化促進剤、無機質充填材を必須成分として含有するものであることが好ましく、その組成は特開平８－６７７４１号公報、特開平８－６７７４２号公報、特開平８－６７７４５号公報に示されており、その形状は粉末状又は顆粒状であり、トランスファ成形の場合のようにタブレットに賦形する必要はない。そして、射出ユニットのシリンダ内での熱安定性が良好であり、キャビティ内で流動性が特に良好で、速やかに硬化するものであることが好ましい。

【００１４】本発明において使用する射出ユニットに特に制限はなく、例えば、スクリューインライン式、プランジャ式、スクリュープランジャ式等を挙げることができる。これらの中で、スクリューインライン式の射出ユニットを特に好適に使用することができる。材料供給から射出に至るまでの射出ユニット内の工程は、材料供給・計量・混練・圧縮・溶融・射出となっており、特に可塑化部分である混練・圧縮・溶融部がスクリューインライン式である場合は、半導体の封止成形において、最も重要視されるボイドを少なくすることができる。スクリューにより射出ユニット前方に押し出され計量されたエポキシ樹脂封止材料に一定の圧力を加えることにより、スクリューは回転しながら後退し、その際、材料の可塑化と均一混練が行われる。さらに、スクリューの後側から加圧するこの圧力を調整することにより、樹脂に含まれている揮発分や空気を材料投入口側に逃がすことができる。また、溶融後の射出は、スクリュー、プランジャ等を用いることができるが、構造の簡単さ、取り扱いの容易さ、射出ユニットの省スペース化等の点から、スクリューインライン式であることが好ましい。本発明方法においては、射出ユニットを使用するので、従来方式のトランスファ成形における可塑化工程であるタブレットの高周波プレヒータを使用した予熱及び金型ポット内での予熱に比較し、均一溶融性に優れ、樹脂粘度の低下に伴う流動性の向上、材料の流路であるスプルー、ランナー等の短小化による硬化廃棄物の削減、硬化時間の短縮等、生産性の向上及びボイドの減少に代表される品質の向上の点で優れている。

【００１５】従来のトランスファ成形装置は、半導体が接合され、ワイヤボンディングされたリードフレーム又は半導体が接合されたリード線をインサートとして封止成形するための成形金型、成形金型を開閉するための型締めユニット、材料を供給するタブレット供給装置、タブレットを加圧するプランジャ機構、リードフレーム又はリード線及びタブレットの集積・整列・搬送を行うインローダユニット、金型分割面のバリ・汚れ等を清掃するクリーニングユニット、成形物の取り出し・カルランナーと成形品の分離を行うゲートブレイクユニット、分離後のリードフレーム又はリード線を搬送・集積するアンローダで構成されるのが一般的である。本発明の半導体封止成形装置は、従来のトランスファ成形システムの中で、タブレット供給装置の代わりに、粉末状又は顆粒状のエポキシ樹脂封止材料を、空輸方式、カセット方式等の材料供給装置で供給し、更に、キャビティ内にタブレットを予備加熱して移送するプランジャ機構の代わりに、材料を均一混練し溶融した状態で射出する射出ユニ

ットで構成されている。

【００１６】本発明の半導体封止成形装置によれば、エポキシ樹脂封止材料の供給から成形までの形態が粉末状又は顆粒状であり、射出ユニットにより、エポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、射出するので、タブレットの賦形が不要であり、材料の流動性の向上や硬化廃棄物の削減が可能となる。更に、硬化時間の短縮、ボイドの低減等の生産性・品質の向上において優れている。

【００１７】本発明の半導体封止成形装置においては、金型として、スプルーレス金型を使用することができる。即ち、金型のスプルー部の温度を、エポキシ樹脂封止材料の硬化が起こり難い温度、つまりシリンダ内の温度とほぼ同等か、エポキシ樹脂封止材料の溶融粘度によっては硬化が進行する温度よりやや低い温度にコントロールすることにより、成形品を取り出した後に、次のサイクルでスプルー部の未硬化のエポキシ樹脂封止材料をキャビティ内へ射出して成形することができる。この方式を実施することにより、通常の成形方式より、更に硬化廃棄物の量を大きく低減することができる。

【００１８】本発明装置において、射出ユニット内のスクリューは、スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が８～１２であり、より好ましくは（Ｌ／Ｄ）が９～１１である。可塑化工程に要求される射出ユニットの機能のうち、成形されるエポキシ樹脂封止材料の溶融特性により、スクリューの可塑化性能、即ちスクリュー形状が決定される。一般的には、この性能を判断する形状の特徴として、スクリューの有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）、スクリューのネジ溝ピッチＰとスクリュー径Ｄの比（Ｐ／Ｄ）、スクリューの材料供給部のネジ溝面積と計量部のネジ溝面積の比である圧縮比等がある。本発明装置において、射出ユニット内のスクリューは、（Ｐ／Ｄ）及び圧縮比については特に制限はなく、一般的な熱硬化性樹脂射出成形機のスクリューと同等とすることができる。（Ｌ／Ｄ）が８未満であると、エポキシ樹脂封止材料に対する可塑化能力が不足し、封止材料の溶融が不均一となるおそれがある。（Ｌ／Ｄ）が１２を超えると、成形装置の全高が高くなりすぎるおそれがある。

【００１９】スクリュー有効長Ｌとスクリュー径Ｄの比（Ｌ／Ｄ）が大きく、材料供給部の長さが大きければ、可塑化能力が高く、混練状態も向上するので、通常は（Ｌ／Ｄ）は１４～１８程度に設定されている。材料の計量の段階では、スクリューが回転しながら後退し、材料の可塑化が行われるが、（Ｌ／Ｄ）が小さすぎる場合は、材料の可塑化に必要なスクリュー長さが短く、スクリューが後退するとき、シリンダの温度制御ゾーンに対するスクリューの位置関係が常に変化し、溶融温度バラツキや混練状態のバラツキが発生しやすい。本発明装置においては、（Ｌ／Ｄ）を８～１２と従来より小さくすることにより、スクリュー有効長Ｌも短くすることが可能となる。本発明装置においては、スクリュー有効長Ｌは２５０～４００㎜であることが好ましく、２８０～３５０㎜であることがより好ましい。スクリュー有効長Ｌを２５０～４００㎜とすることにより、エポキシ樹脂封止材料に対する十分な可塑化能力を維持したまま、成形装置全体の高さを３，０００㎜以下として、在来のクリーンルーム内への設置が可能となる。

【００２０】本発明の半導体封止成形装置においては、射出ユニット内の材料投入部における投入口及び流入部の表面粗さがいずれも０．４０～６．３μｍＲａであることが好ましく、１．６０～４．０μｍＲａであることがより好ましい。また、投入口と流入部の接続部に段差がない形状であることが好ましい。射出ユニット部のシリンダ構成は、水冷回路を有するシリンダ取り付け部及びシリンダに区分され、図３に示されるように、水冷回路を有するシリンダ取り付け部には材料投入口１６が、シリンダには材料流入部１７が形成されている。粉末状又は顆粒状のエポキシ樹脂封止材料は、空輸、カセット等により、材料投入口から投入される。投入口の壁面が水平面となす角度は、粉末状又は顆粒状のエポキシ樹脂封止材料の流動特性の指標である安息角より大きいことが好ましいが、シリンダ取り付け部と射出ユニットの駆動機構部との位置関係より、安息角より大きい角度とすることが困難な場合が多く、通常は４５度程度である。この程度の角度では、熱可塑性樹脂成形機の材料投入部で一般的な表面粗さ、即ち３．２～１００μｍＲａであると、粉末状又は顆粒状のエポキシ樹脂封止材料は流動性が悪いため、投入口又は流入部で材料のブリッジが発生し、計量バラツキ、計量時間のバラツキ及び材料供給不足等の問題が発生し、連続運転が困難となるおそれがある。本発明装置においては、投入口及び流入部の表面粗さを０．４０～６．３μｍＲａとし、特に水冷回路を有するシリンダ取り付け部の流入部を１．６～６．３μｍＲａに加工し、かつ投入口と流入部の接続部に段差がない形状とすることにより、エポキシ樹脂封止材料のブリッジの発生を防止し、粉末状又は顆粒状の材料の連続供給性及び連続生産性に優れた封止成形が可能となる。投入口及び流入部の表面粗さは０．４０μｍＲａであれば、粉末状又は顆粒状のエポキシ樹脂封止材料を十分に安定して供給することができ、表面粗さを０．４０μｍＲａ未満とすることは通常は不必要であり、いたずらに加工コストが高くなるのみである。投入口及び流入部の表面粗さが６．３μｍＲａを超えると、粉末状又は顆粒状のエポキシ樹脂封止材料にブリッジが発生し、供給が不安定となるおそれがある。

【００２１】

【実施例】以下に、実施例を挙げて本発明をさらに詳細に説明するが、本発明はこれらの実施例によりなんら限定されるものではない。なお、実施例及び比較例におい

て、封止成形品等の評価は下記の方法により行った。
（１）材料圧縮率
水中置換法にてトランスファ成形ではタブレット、射出成形では射出物の見掛け比重を測定し、硬化物（成形品）の真比重に対する比率を％で示す。材料圧縮率が小さいことは、成形されたタブレット又は射出成形品の圧縮比が小さく、空気等を多く含み、成形品中に微小ボイドを多く含むことを意味する。
（２）充填性
成形品５０個について、倍率１０倍の実体顕微鏡を用いて、表面の未充填箇所の有無を観察する。
（３）バリ
成形品５０個について、リードフレームのタイバ部のバリ伸び程度を観察する。
（４）内部ボイド
成形品５０個について、超音波を照射して直径０．５㎜以上の大きさの内部ボイドを観察する。
（５）微少ボイド
倍率１，０００倍の電子顕微鏡を用いて、ＩＣ素子が接合されている面の破断面のボイドの多さの程度を観察する。
（６）ワイヤスイープ
成形品に軟Ｘ線を照射して、ボンディングワイヤ（直径３０μｍ，長さ３．２㎜のセミハード金線）の流れ（変形）量を測定し、ＩＣ素子端面とリード端子のボンディング間の距離に対する最大ワイヤ流れ量の比率を％で示す。
（７）硬化廃棄物
カル及びスプルーとランナー部の廃棄物量が、全封止材料に占める割合を重量％で示す。
実施例１
図１、図２及び図３に示す本発明の半導体封止成形装置を用いて、エポキシ樹脂封止材料による半導体の封止成形を行った。射出ユニットのスクリューの有効長Ｌは３００㎜、スクリュー径Ｄは３０㎜であり、（Ｌ／Ｄ）は１０である。また、材料投入部において、投入口及び流入部の表面粗さは、いずれも３．２μｍＲａである。エポキシ樹脂封止材料としては、住友ベークライト(株)製スミコン「ＥＭＥ－Ｊ００１」を使用した。シリンダ設定温度８３℃、射出圧力１，３００kgf／cm$^2$、射出速度５～１０㎜／秒、金型温度１８０℃に設定し、スプルーレス成形を行った。金型は、８キャビティ／１フレームで、４フレームの３２個取りとした。ＩＣ素子（６４ｐＱＦＰ）を接合し、金線ボンディングされた銅製リードフレームを金型にセットし、成形サイクル８７秒で全自動成形した。射出ユニットより射出されたエポキシ樹脂封止材料及び封止された成形品について、評価を行った。材料圧縮率は９６～９８％であり、５０個の成形品について、未充填箇所、タイバ部のバリ伸び、内部ボイドは認められなかった、また、微小ボイドは少なく、ワイヤスイープは５％以下であり、硬化廃棄物量は３４重量％であった。
比較例１
実施例１と同じ材料を用いて、従来から実施されているタブレットを使用したマルチ・トランスファ成形システムにより、成形サイクル１０５秒で、半導体の封止成形を行った。材料圧縮率は９２～９４％であり、５０個の成形品について、未充填箇所、タイバ部のバリ伸び、内部ボイドは認められなかった、また、微小ボイドが多数あり、ワイヤスイープは５％以下であり、硬化廃棄物量は４２重量％であった。実施例１及び比較例１の結果を、第１表に示す。
【００２２】
【表１】
第１表

| | 実施例１ | 比較例１ |
|---|---|---|
| 材料圧縮率（％） | ９６～９８ | ９２～９４ |
| 充填性 | ０／５０ | ０／５０ |
| バリ | ０／５０ | ０／５０ |
| 内部ボイド | ０／５０ | ０／５０ |
| 微小ボイド | 少 | 多数 |
| ワイヤスイープ（％） | ＜５ | ＜５ |
| 硬化廃棄物（重量％） | ３４ | ４２ |
| 成形サイクル（秒） | ８７ | １０５ |

【００２３】第１表に見られるように、本発明方法及び装置を用いて成形した実施例１は、従来のマルチ・トランスファ成形による比較例１に比べて、充填性、バリ、内部ボイド及びワイヤスイープに関しては差がないが、材料圧縮率が高く、微小ボイドが少ない点で優れている。また、成形サイクルが短く、硬化廃棄物の割合が少ないことから、生産性及び経済性にも優れていることが分かる。
【００２４】
【発明の効果】本発明の半導体封止成形方法及び装置によれば、射出ユニットを使用して、エポキシ樹脂封止材料の供給から成形までを、粉末状又は顆粒状のエポキシ樹脂封止材料を供給し、スクリュー機構で均一混練・溶融し、射出するので、従来のトランスファ成形のようなタブレットの賦形が不要であり、エポキシ樹脂封止材料の粘度低下による流動性向上や、硬化廃棄物の削減が可能であり、更には硬化時間、充填時間、予熱時間の短縮によるサイクル短縮及び微小ボイドの低減等の生産性・品質面において優れた半導体封止成形を行うことができる。また、スクリュー形状及び粉末状又は顆粒状の材料を投入する部位を、従来の概念にとらわれずに検討したことにより、均一混練・溶融が可能となり、連続成形性に優れた半導体封止成形方法及び装置を得ることができた。竪型締め・竪射出の成形装置では、全高も３，００

０㎜以下となり、在来のクリーンルーム内への設置が可能となった。一般的な熱可塑性樹脂あるいは熱硬化性樹脂の射出成形機に比較しても、射出ユニット長は大幅に縮小され、省スペース化に大きく寄与することができる。

【図面の簡単な説明】

【図１】図１は、本発明の半導体封止成形装置の一態様の概略正面図である。

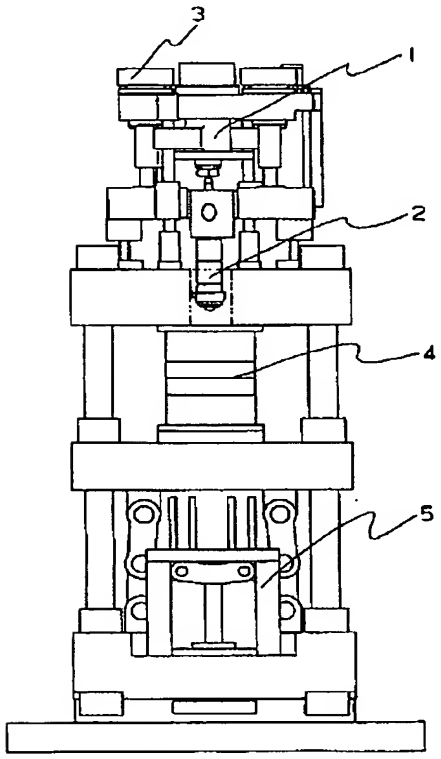
【図２】図２は、図１に示す成形装置の成形要部の概略平面図である。

【図３】図３は、図１に示す成形装置の射出ユニット部の要部断面図である。

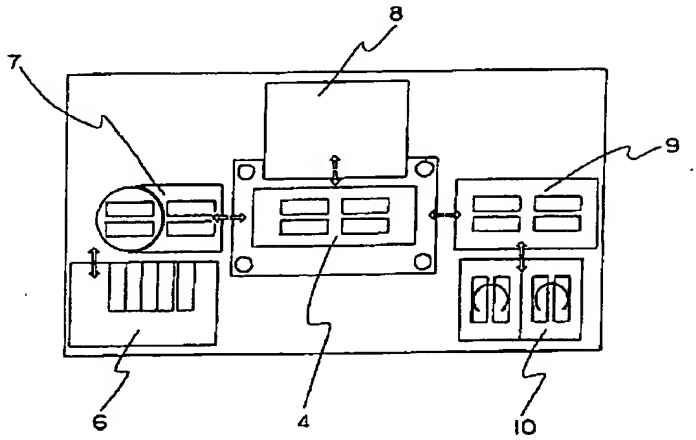
【符号の説明】

１　射出ユニット
２　スクリューコンプリート
＊３　駆動部
４　成形金型
５　型締めユニット
６　インマガジン
７　フレームシュータ
８　クリーニングユニット
９　ゲートブレイク
１０　アウトカセット
１１　シリンダ
１２　ノズルチップ
１３　温調ジャケット
１４　スクリュー
１５　シリンダ取り付け部
１６　材料投入口
＊１７　材料流入部

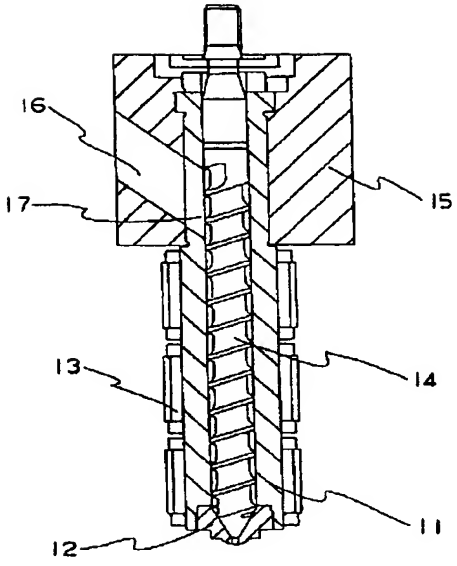
【図１】




【図２】



【図３】




---

フロントページの続き

(72)発明者　吉住　文成
東京都品川区東品川２丁目５番８号　住友ベークライト株式会社内
(72)発明者　南　勝則
東京都品川区東品川２丁目５番８号　住友ベークライト株式会社内
(72)発明者　鈴木　栄作
新潟県新潟市岡山1300番地　株式会社新潟鐵工所新潟精機工場内
(72)発明者　早川　憲司
新潟県新潟市岡山1300番地　株式会社新潟鐵工所新潟精機工場内

Ｆターム(参考)　4F206 AA39 AH37 JA07 JC08 JD03
JF01 JF46 JQ11
4M109 AA01 BA01 CA21 EA02 EB03
EB04 EB12 GA10

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-068416
(43)Date of publication of application : 03.03.2000

(51)Int.Cl. H01L 23/28
B29C 45/14
B29C 45/60
// B29L 31:34

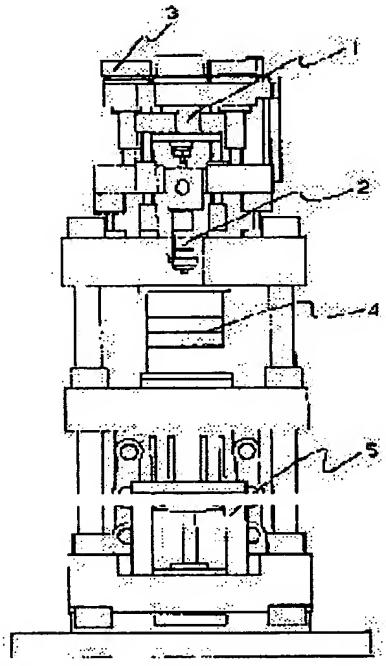
(21)Application number : 10-234214
(22)Date of filing : 20.08.1998

(71)Applicant : SUMITOMO BAKELITE CO LTD
NIIGATA ENG CO LTD

(72)Inventor : ITO HIDEO
YOSHIZUMI FUMINARI
MINAMI KATSUNORI
SUZUKI EISAKU
HAYAKAWA KENJI

## (54) METHOD AND DEVICE FOR SEALING SEMICONDUCTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method by which a semiconductor is sealed, in a short sealing cycle with small amount of cured wastage and few fine voids in a cured sealing material and a device usable for putting the method into practice and which is small in height and is easily installed in a conventional clean room.
SOLUTION: This method and device for fixing a lead frame having a semiconductor bonded thereto and a wire bonding or a lead wire which has a semiconductor bonded thereto as an insert and then sealing this with an epoxy resin sealing material, has a powder-like or particle-like epoxy resin sealing material supplied to an injection unit 1 and which is mixed uniformly and melted by a screw mechanism and then is injected into a cavity with a screw or a plunger, and the injected sealing material is cured to seal the semiconductor, wherein the injection unit 1 is a screw having a ratio of an effective length L to a diameter D L/D of 8 to 12.




LEGAL STATUS

| | |
|---|---|
| [Date of request for examination] | 24.08.2000 |
| [Date of sending the examiner's decision of rejection] | |
| [Kind of final disposal of application other than the examiner's decision of rejection or application converted registration] | |
| [Date of final disposal for application] | |
| [Patent number] | 3436490 |
| [Date of registration] | 06.06.2003 |
| [Number of appeal against examiner's decision of rejection] | |
| [Date of requesting appeal against examiner's decision of rejection] | |
| [Date of extinction of right] | |

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-068416

(43)Date of publication of application : 03.03.2000

(51)Int.Cl. H01L 23/28
B29C 45/14
B29C 45/60
// B29L 31:34

(21)Application number : 10-234214

(22)Date of filing : 20.08.1998

(71)Applicant : SUMITOMO BAKELITE CO LTD
NIIGATA ENG CO LTD

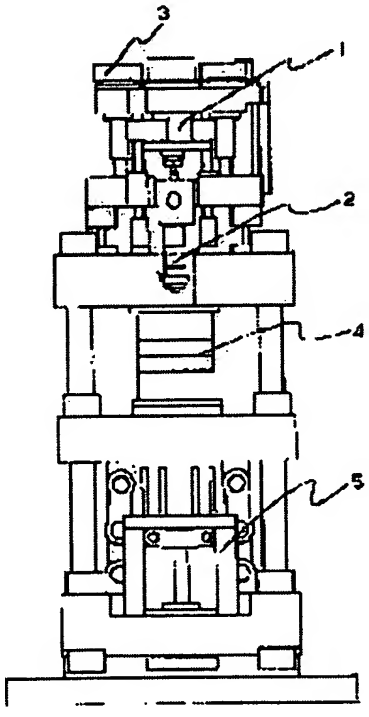
(72)Inventor : ITO HIDEO
YOSHIZUMI FUMINARI
MINAMI KATSUNORI
SUZUKI EISAKU
HAYAKAWA KENJI

## (54) METHOD AND DEVICE FOR SEALING SEMICONDUCTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method by which a semiconductor is sealed, in a short sealing cycle with small amount of cured wastage and few fine voids in a cured sealing material and a device usable for putting the method into practice and which is small in height and is easily installed in a conventional clean room.

SOLUTION: This method and device for fixing a lead frame having a semiconductor bonded thereto and a wire bonding or a lead wire which has a semiconductor bonded thereto as an insert and then sealing this with an epoxy resin sealing material, has a powder-like or particle-like epoxy resin sealing material supplied to an injection unit 1 and which is mixed uniformly and melted by a screw mechanism and then is injected into a cavity with a screw or a plunger, and the injected sealing material is cured to seal the semiconductor, wherein the injection unit 1 is a screw having a ratio of an effective length L to a diameter D L/D of 8 to 12.



LEGAL STATUS

| | |
|---|---|
| [Date of request for examination] | 24.08.2000 |
| [Date of sending the examiner's decision of rejection] | |
| [Kind of final disposal of application other than the examiner's decision of rejection or application converted registration] | |
| [Date of final disposal for application] | |
| [Patent number] | 3436490 |
| [Date of registration] | 06.06.2003 |
| [Number of appeal against examiner's decision of rejection] | |
| [Date of requesting appeal against examiner's decision of rejection] | |
| [Date of extinction of right] | |

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]
[Claim 1] In the shaping approach which fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient The epoxy resin closure ingredient of powdered or granularity is supplied to an injection unit. It is the semi-conductor closure shaping approach which closes a semi-conductor by homogeneity-kneading, fusing by the screw device, injecting in a cavity with a screw or a plunger, and stiffening said injected closure ingredient. As an injection unit The semi-conductor closure shaping approach characterized by using the screw whose ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw are 8-12.
[Claim 2] In the shaping equipment which fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient Supply the epoxy resin closure ingredient of powdered or granularity, and by the screw device, homogeneity-knead and it fuses. It has the injection unit injected in a cavity with a screw or a plunger. Semi-conductor closure shaping equipment which is semi-conductor closure shaping equipment which closes a semi-conductor by stiffening said injected closure ingredient, and is characterized by the screw in an injection unit being [ the ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw ] 8-12.
[Claim 3] Semi-conductor closure shaping equipment according to claim 2 whose screw effective length L is 250-400mm.
[Claim 4] Semi-conductor closure shaping equipment according to claim 2 which each surface roughness of input port and the inflow section is 0.40-6.3micromRa in the ingredient injection section in an injection unit, and is the configuration which does not have a level difference in the connection of input port and the inflow section.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the semi-conductor closure shaping approach and equipment. This invention excels [ molding cycle ] in productivity short in more detail, it is useful to operation of the semi-conductor closure shaping approach with few [ there are few amounts of hardening trash and ] minute voids in the hardened epoxy resin closure ingredient, and this shaping approach, and, moreover, installation into the ordinary clean room where an overall height is low is related with easy semi-conductor closure shaping equipment.
[0002]
[Description of the Prior Art] Transfer molding of an epoxy resin closure ingredient is conventionally used for the closure of IC, LSI, and the semi-conductor of discrete ** as an approach suitable for low cost, high-reliability, and productivity. Supplying to the pot in metal mold and carrying out heating melting to it, it transports into a metal mold cavity and is made to harden by pressurizing with a plunger in transfer molding, after carrying out size enlargement of the epoxy resin closure ingredient to the shape of a tablet.
[0003] However, since it will be the requisite to carry out size enlargement of the epoxy resin closure ingredient to the shape of a tablet, the process of size enlargement is required of this shaping approach. Since various configurations of a required tablet change with the configuration and magnitude of the semiconductor package fabricated, much metal mold for size enlargement is also need. Moreover, for every shaping, since an injection of a tablet and thermofusion are required, a molding cycle cannot be shortened below to fixed time amount. furthermore, in order that the runner section which be passage until the epoxy resin closure ingredient fed into the pot flow the inside of metal mold and reach in a cavity, and the cull section remaining within a pot may harden completely, there be a problem of a lot of hardening trash in addition to the semiconductor package section to need be generate, and a limitation be in low cost-izing and high-volume production capability from these points.
[0004] On the other hand, examination of an injection-molding system has been conventionally performed as the shaping approach of the thermosetting resin molding material containing an epoxy resin. In injection molding, it is supplied in granularity, and it is injected [ that an epoxy resin molding compound is powdered in an injection molding machine, or ] by metal mold on a screw, maintaining a melting condition within a cylinder. For this reason, the process which carries out size enlargement to the shape of a tablet is unnecessary, and the equipment and time amount for size enlargement can be omitted. Moreover, in order to inject in the state of melting, there is no constraint of the diameter of a tablet and weight like transfer molding, and it can apply to various semiconductor packages easily. Furthermore, it is an approach suitable for mass production method that it can produce continuously, and the setting time is shortened compared with transfer molding, and the runner section and the sprue section which are passage can be lessened since it will be in a homogeneity melting condition and the hypoviscosity-ized molding material is injected by metal mold etc.
[0005] However, injection molding was not conventionally put in practical use as the shaping approach

of an epoxy resin closure ingredient. As the reason, the conventional epoxy resin closure ingredient is because the thermal stability of the epoxy resin closure ingredient which viscosity increases, has the property to lose a fluidity in 5 - 10 minutes, and was fused by advance of the hardening reaction of the resin in an epoxy resin closure ingredient in the state of melting within the cylinder heated by 70-110 degrees C is remarkable and low. For this reason, injection molding in low voltage is impossible, injection molding in high pressure was needed, and, as a result, the electric performance degradation by the pressurization to an internal component etc. resulted in spoiling the dependability of the semiconductor package obtained remarkably for deformation of the bonding wire on a semi-conductor, cutting, or diode. Moreover, when fixed time amount interruption of the shaping was carried out for cleaning of metal mold etc., since it hardened within a cylinder and injection for the second time became impossible, the epoxy resin closure ingredient also had the problem of causing trouble also in the mass production.

[0006] Although the screw configuration in the injection unit of a thermosetting resin injection molding machine changes variously with each making machine manufacturers, more generally than relation, such as a configuration of uniform plasticization melting and the temperature control zone of a cylinder, balance of die length, and a measuring stroke, the ratio (ratio of length to diameter) of the screw effective length L and the diameter D of a screw is ratio-of-length-to-diameter=14-18. For this reason, as for the dimension of the metal mold which injects and stiffens an ingredient in a cavity, and the whole equipment including the mold clamp device which opens and closes that metal mold, it is common to exceed 3,000mm as an overall height of a vertical-type bundle and ******. In ******, a shaping manufacturer's head-lining height has many cases of the blow by to the second floor. however, in semi-conductor shaping, an environment thinks as important from a viewpoint of protection of a semi-conductor -- having -- constant temperature -- since - constant humidity and clean-ization are called for, it is an all-rooms clean room. Therefore, the installation tooth space of shaping equipment has constraint, and all the overall heights of transfer-molding equipment have become 3,000mm or less. Especially in the case of injection-molding equipment, the overall height of shaping equipment became high with the die length of an injection unit, and the problem that it could not install in a clean room had arisen.

[0007] In the case of common thermosetting resin, the configuration of the injection unit from a closure ingredient injection to injection is classified into the cylinder installation section which has a cylinder and a water-cooled circuit. The quality of the material of the cylinder installation section has many castings, and the surface roughness of ingredient input port which performed simple machining is usually 50-100micromRa, and even if it finish-machines, it is 12.5-25micromRa. The quality of the material of a cylinder has much heat-treated special steel material, and the surface roughness of the ingredient style admission into a club prepared in the cylinder is 3.2-25micromRa. Moreover, in the connection of input port and the inflow section, the level difference has arisen in many cases. Although it is such surface roughness, and it will be hard to generate a problem to the fluidity in an ingredient injection part when it is the pellet type molding compound of thermoplastics if the level difference has arisen at the time of assembly, in the case of powdered or the epoxy resin closure ingredient supplied by granularity, a fluidity is bad, a bridge is generated in input port and the inflow section, and measuring variation and the problem of an ingredient not being supplied if it pulls tend to occur.

[0008]

[Problem(s) to be Solved by the Invention] This invention excels [ molding cycle ] in productivity short, it is useful to operation of the semi-conductor closure shaping approach with few [ there are few amounts of hardening trash and ] minute voids in the hardened epoxy resin closure ingredient, and this shaping approach, and, moreover, installation into the ordinary clean room where an overall height is low is made for the purpose of offering easy semi-conductor closure shaping equipment.

[0009]

[Means for Solving the Problem] this invention persons by using the screw whose ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw are 8-12 as an injection unit, as a result of repeating research wholeheartedly that the above-mentioned technical problem should be

solved Closure shaping by the epoxy resin closure ingredient of powdered or granularity can be performed smoothly. Furthermore, by setting screw effective length to 250-400mm, setting the ingredient input port in an injection unit, and surface roughness of the inflow section to 0.40-6.3micromRa, and considering as the configuration which does not have a level difference in input port and the connection part of the inflow section It finds out that closure shaping can be performed much more efficiently, and came to complete this invention based on this knowledge. Namely, this invention fixes as an insertion the lead wire to which (1) semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and sets it to the shaping approach which closes this with an epoxy resin closure ingredient. The epoxy resin closure ingredient of powdered or granularity is supplied to an injection unit. It is the semi-conductor closure shaping approach which closes a semi-conductor by homogeneity-kneading, fusing by the screw device, injecting in a cavity with a screw or a plunger, and stiffening said injected closure ingredient. As an injection unit The semi-conductor closure shaping approach characterized by using the screw whose ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw are 8-12, (2) In the shaping equipment which fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient Supply the epoxy resin closure ingredient of powdered or granularity, and by the screw device, homogeneity-knead and it fuses. It has the injection unit injected in a cavity with a screw or a plunger. It is semi-conductor closure shaping equipment which closes a semi-conductor by stiffening said injected closure ingredient. The semi-conductor closure shaping equipment with which the screw in an injection unit is characterized by the ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw being 8-12, (3) In the semi-conductor closure shaping equipment given in ** (2) term the given screw effective length L is 250-400mm, and the ingredient injection section in (4) injection units The semi-conductor closure shaping equipment given in ** (2) term which each surface roughness of input port and the inflow section is 0.40-6.3micromRa, and is the configuration which does not have a level difference in the connection of input port and the inflow section is offered.

[0010]

[Embodiment of the Invention] In the shaping approach which the semi-conductor closure shaping approach of this invention fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient The epoxy resin closure ingredient of powdered or granularity is supplied to an injection unit. It is the semi-conductor closure shaping approach which closes a semi-conductor by homogeneity-kneading, fusing by the screw device, injecting in a cavity with a screw or a plunger, and stiffening said injected closure ingredient. As an injection unit The ratio (ratio of length to diameter) of the screw effective length L and the diameter D of a screw uses the screw which are 8-12. In the shaping equipment which the semi-conductor closure shaping equipment of this invention fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient Supply the epoxy resin closure ingredient of powdered or granularity, and by the screw device, homogeneity-knead and it fuses. It has the injection unit injected in a cavity with a screw or a plunger. By stiffening said injected closure ingredient, it is semi-conductor closure shaping equipment which closes a semi-conductor, and the screw in an injection unit is [ the ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw ] 8-12.

[0011] The semi-conductor closure shaping equipment of drawing 1 of this invention is an outline front view [ like ] 1 voice, drawing 2 is the outline top view of the shaping important section, and drawing 3 is the important section sectional view of the injection unit. the voice shown in drawing 1 -- the shaping equipment with which it is joined and, as for semi-conductor closure shaping equipment [ like ], a semi-conductor closes the leadframe by which wirebonding was carried out -- it is -- an injection unit 1 and a screw -- complete -- it has 2, a mechanical component 3, the shaping metal mold 4, and the mold clamp unit 5. As shown in drawing 1 and drawing 2 , the shaping important section A semi-conductor is joined

and the leadframe by which wirebonding was carried out is contained. The in magazine 6 transported to degree process, the frame shooter 7 which conveys the transported leadframe to alignment and metal mold, powdered or the injection unit 1 which kneads and fuses the epoxy resin closure ingredient supplied by granularity, and injects it in a cavity, and a leadframe are considered as an insertion. A semi-conductor The shaping metal mold 4 and shaping metal mold which carry out closure shaping It consists of out cassettes 10 which convey and accumulate the mold clamp unit 5 opened and closed, the cleaning unit 8 which cleans the cavity front face of shaping metal mold, the fabricated leadframe, and the gate break 9 which separates the runner gate and the fabricated leadframe. It is substantially [ as the shaping equipment which also shows the shaping equipment which closes the lead wire to which the semi-conductor was joined to drawing 1 ] the same.

[0012] this invention equipment -- setting -- the screw of an injection unit 1 -- complete -- 2 has a configuration as shown in drawing 3 . That is, it has a cylinder 11, the nozzle tip 12 connected with a screw, the temperature control jacket 13 which performs temperature control of a cylinder, the screw 14 which performs migration, kneading, and melting of an epoxy resin closure ingredient, and the cylinder installation section 15 which has a water-cooled circuit, and the ingredient style admission into a club 17 is formed in ingredient input port 16 and a cylinder at the cylinder installation section. The epoxy resin closure ingredient of powdered or granularity is thrown in from ingredient input port 16, and is supplied in a cylinder 11 via the ingredient style admission into a club 17. A screw 14 retreats rotating, performs ingredient measuring of the specified quantity, and transports an ingredient to the front. At this time, plasticization kneading and melting compressing, it is transported to the front and an epoxy resin closure ingredient is accumulated in a nozzle tip 12 in the condition of having been hypoviscosity-ized by the internal-friction heat by screw rotation, and the heat tracing from the temperature control jacket 13. Then, after being injected in a cavity and passing through the predetermined setting time by advance of a screw 14, closure shaping of a semi-conductor is completed a mold aperture and by carrying out ejection. [0013] As for the epoxy resin closure ingredient used in this invention approach, it is desirable that it is what contains an epoxy resin, a phenol resin system curing agent, a hardening accelerator, and a minerals filler as an indispensable component, and it is shown in JP,8-67741,A, JP,8-67742,A, and JP,8-67745,A, and the configuration is powdered or granularity and does not have to carry out size enlargement of the presentation to a tablet like [ in transfer molding ]. And the thermal stability within the cylinder of an injection unit is good, within a cavity, especially a fluidity is good and it is desirable that it is what is hardened promptly.

[0014] There is especially no limit in the injection unit used in this invention, for example, a screw in-line type, a plunger type, a screw plunger ceremony, etc. can be held. In these, the injection unit of a screw in-line type can be used especially suitably. The process in an injection unit until it results [ from ingredient supply ] in injection serves as ingredient supply, measuring, kneading, compression, melting, and injection, and when kneading, the compression, and the fusion zone which is especially a plasticization part are screw in-line types, it can lessen the void to which importance is attached most in closure shaping of a semi-conductor. By applying a fixed pressure to the epoxy resin closure ingredient which was extruded ahead [ injection unit ] on the screw and was measured, a screw retreats rotating and plasticization and homogeneity kneading of an ingredient are performed in that case. Furthermore, the volatile matter and air which are included in resin can be missed to an ingredient input port side by adjusting this pressure pressurized from the backside [ a screw ]. Moreover, although injection after melting can use a screw, a plunger, etc., it is desirable that it is a screw in-line type from points, such as simplicity of structure, an ease of handling, and space-saving-izing of an injection unit. It compares with the preheating which used the RF pre-heater of the tablet which is a plasticization process in transfer molding of the conventional method in this invention approach since the injection unit was used, and the preheating within a metal mold pot. It excels in homogeneity melting nature and reduction of the hardening trash by little-izing of the sprue which is the fluid improvement and the passage of an ingredient accompanying the fall of resin viscosity, a runner, etc., compaction of the setting time, etc. are excellent in respect of improvement in the quality represented by the improvement in productivity, and reduction of a void.

[0015] The shaping metal mold for conventional transfer-molding equipment considering as an insertion lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and carrying out closure shaping, The mold clamp unit for opening and closing shaping metal mold, the tablet feeder which supplies an ingredient, The in loader unit which performs accumulation, alignment, and conveyance of the plunger style which pressurizes a tablet, a leadframe or lead wire, and a tablet, It is common to consist of unloaders which convey and accumulate the leadframe or lead wire after the cleaning unit which cleans the weld flash, dirt, etc. of a metal mold parting plane, the gate break unit which performs separation of mold goods with the ejection and the cull runner of a moldings, and separation. The semi-conductor closure shaping equipment of this invention supplies the epoxy resin closure ingredient of powdered or granularity by ingredient feeders , such as an air transport method and a cassette system , instead of a tablet feeder in the conventional transfer-molding system , and consists of injection units which inject an ingredient in the condition of having carry out homogeneity kneading and having fuse further instead of the plunger style which carries out preheating of the tablet and transports it into a cavity .

[0016] According to the semi-conductor closure shaping equipment of this invention, the gestalt from supply of an epoxy resin closure ingredient to shaping is powdered or granularity, with an injection unit, supply an epoxy resin closure ingredient, and it kneads [ homogeneity ] and fuses by the screw device, and since it injects, the size enlargement of a tablet is unnecessary and becomes reducible [ the fluid improvement in an ingredient, or hardening trash ]. Furthermore, it excels in improvement in productivity and quality, such as compaction of the setting time, and reduction of a void.

[0017] In the semi-conductor closure shaping equipment of this invention, sprue loess metal mold can be used as metal mold. That is, after taking out mold goods by controlling the temperature of the sprue section of metal mold to temperature a little lower than the temperature from which hardening of an epoxy resin closure ingredient cannot take place easily, i.e., the temperature to which equivalent [ to the temperature in a cylinder / almost ] or hardening advances depending on the melt viscosity of an epoxy resin closure ingredient, the epoxy resin closure ingredient which is not hardened [ of the sprue section ] can be injected and fabricated in the following cycle into a cavity. By carrying out this method, the amount of hardening trash can be further reduced greatly from the usual shaping method.

[0018] this invention equipment -- setting -- the screw in an injection unit -- the ratio (ratio of length to diameter) of the screw effective length L and the diameter D of a screw -- 8-12 -- it is -- more -- being desirable (ratio of length to diameter) -- it is 9-11. It is determined by the melting property of the epoxy resin closure ingredient fabricated among the functions of the injection unit required of a plasticization process, the plasticization engine performance, i.e., the screw configuration, of a screw. Generally, there is a compression ratio which are the effective length L of a screw, the ratio (ratio of length to diameter) of the diameter D of a screw, the screw slot pitch P of a screw and the ratio (P/D) of the diameter D of a screw, and a ratio of the screw groove surface product of the ingredient feed zone of a screw and the screw groove surface product of a metering zone as a description of a configuration of judging this engine performance. In this invention equipment, there is especially no limit about the screw in an injection unit, and (P/D) a compression ratio, and suppose that it is equivalent to the screw of a common thermosetting resin injection molding machine. Plasticizing capacity [ as opposed to / that (ratio of length to diameter) is less than eight / an epoxy resin closure ingredient ] is insufficient, and there is a possibility that melting of a closure ingredient may become uneven. When (ratio of length to diameter) exceeds 12, there is a possibility that the overall height of shaping equipment may become high too much.

[0019] If the ratio (ratio of length to diameter) of the screw effective length L and the diameter D of a screw is large and the die length of an ingredient feed zone is large, plasticizing capacity is high, and since a kneading condition also improves, it is usually (ratio of length to diameter) set about to 14 to 18. When (ratio of length to diameter) is too small, screw die length required for plasticization of an ingredient is short, and when a screw retreats, the physical relationship of the screw to the temperature control zone of a cylinder always changes, and it is easy to generate melting temperature variation and the variation of a kneading condition, although it retreats while a screw rotates, and plasticization of an

ingredient is performed in the phase of measuring of an ingredient. In this invention equipment, the screw effective length L becomes possible [ shortening ] by making (ratio of length to diameter) smaller than 8-12, and the former. In this invention equipment, as for the screw effective length L, it is desirable that it is 250-400mm, and it is more desirable that it is 280-350mm. Installation into an ordinary clean room is attained using the height of the whole shaping equipment as 3,000mm or less maintaining sufficient plasticizing capacity over an epoxy resin closure ingredient by setting screw effective length L to 250-400mm.

[0020] In the semi-conductor closure shaping equipment of this invention, it is desirable that each surface roughness of the input port in the ingredient injection section in an injection unit and the inflow section is 0.40-6.3micromRa, and it is more desirable that it is 1.60-4.0micromRa. Moreover, it is desirable that it is the configuration which does not have a level difference in the connection of input port and the inflow section. The cylinder configuration of the injection unit section is classified into the cylinder installation section and the cylinder which have a water-cooled circuit, as shown in drawing 3 , ingredient input port 16 is formed in the cylinder installation section which has a water-cooled circuit, and the ingredient style admission into a club 17 is formed in the cylinder. The epoxy resin closure ingredient of powdered or granularity is thrown in from ingredient input port by air transport, a cassette, etc. Although it is desirable that it is larger than the angle of repose whose wall surface of input port is the index of the flowability of the epoxy resin closure ingredient of that a horizontal plane and the include angle to make are powdered or granularity, it is difficult to consider as a larger include angle than an angle of repose from the physical relationship of the cylinder installation section and the drive section of an injection unit in many cases, and it is usually about 45 degrees. At an include angle of this level, since the epoxy resin closure ingredient of powdered or granularity has the bad fluidity, the bridge of an ingredient is generated in input port or the inflow section, as it is, the general surface roughness in the ingredient injection section, i.e., 3.2-100micromRa, of a thermoplastics making machine, problems, such as measuring variation, variation of measuring time amount, and ingredient short supply, occur, and there is a possibility that continuous running may become difficult. In this invention equipment, surface roughness of input port and the inflow section is set to 0.40-6.3micromRa. By considering as the configuration which processes into 1.6-6.3micromRa the inflow section of the cylinder installation section which has especially a water-cooled circuit, and does not have a level difference in the connection of input port and the inflow section Generating of the bridge of an epoxy resin closure ingredient is prevented, and closure shaping excellent in the continuation supply nature and continuation productivity of an ingredient of powdered or granularity is attained. If the surface roughness of input port and the inflow section is 0.40micromRa, it is usually unnecessary for it to fully be stabilized, to be able to supply the epoxy resin closure ingredient of powdered or granularity, and to make surface roughness under into 0.40micromRa, and it is only that processing cost becomes high in vain. When the surface roughness of input port and the inflow section exceeds 6.3micromRa, a bridge is generated into the epoxy resin closure ingredient of powdered or granularity, and there is a possibility that supply may become unstable.

[0021]

[Example] Although an example is given to below and this invention is further explained to it at a detail, this invention is not limited at all by these examples. In addition, in the example and the example of a comparison, evaluation of closure mold goods etc. was performed by the following approach.

(1) With an ingredient compressibility underwater substitution method, measure a tablet in transfer molding, measure the apparent specific gravity of a injection object with injection molding, and % shows the ratio to the true specific gravity of a hardened material (mold goods). That ingredient compressibility is small has the small compression ratio of the fabricated tablet or an injection-molded product, and it means that many minute voids are included in mold goods, including air etc. mostly.

(2) Observe the existence of a surface non-filling part about 50 restoration nature mold goods using a stereoscopic microscope 10 times the scale factor of this.

(3) Observe weld flash elongation extent of the tie rod section of a leadframe about 50 weld flash mold goods.

(4) About 50 internal void mold goods, irradiate a supersonic wave and observe the internal void of magnitude with a diameter of 0.5mm or more.
(5) Observe extent of the numerousness of the voids of the fracture surface of the field where IC component is joined using an electron microscope 1,000 times the very small void scale factor of this.
(6) irradiate soft X ray at wire sweep mold goods, measure the amount of flow (deformation) of a bonding wire (the diameter of 30 micrometers, and die length of 3.2mm -- semi -- hard -- a gold streak), and % shows the ratio of the amount of the maximum wire deformation to the distance between the bondings of IC component end face and a lead terminal.
(7) The amount of trash of hardening trash cull and sprue, and the runner section shows the rate of occupying into all closure ingredients, by weight %.
Closure shaping of the semi-conductor by the epoxy resin closure ingredient was performed using the semi-conductor closure shaping equipment of this invention shown in example 1 drawing 1 , drawing 2 , and drawing 3 . 300mm and the diameter D of a screw are 30mm, and (ratio of length to diameter of the effective length L of the screw of an injection unit) is 10. Moreover, in the ingredient injection section, each surface roughness of input port and the inflow section is 3.2micromRa. as an epoxy resin closure ingredient -- Sumi Cong by Sumitomo Bakelite Co., Ltd. -- "EME-J001" was used. It was set as the cylinder laying temperature of 83 degrees C, injection-pressure 1,300 kgf/cm2, the injection speed of 5-10mm/second, and the die temperature of 180 degrees C, and sprue loess shaping was performed. Metal mold is eight cavities / one frame, and was made into 32-piece picking of four frames. IC component (64pQFP) -- joining -- a gold streak -- the copper leadframe by which bonding was carried out was set to metal mold, and full automatic shaping was carried out in molding cycle 87 seconds. It evaluated about the epoxy resin closure ingredient injected from the injection unit, and the mold goods by which the closure was carried out. Ingredient compressibility was 96 - 98%, moreover the weld flash elongation of the non-filling part and tie rod section and an internal void were not accepted about 50 mold goods, there were few minute voids, the wire sweep was 5% or less, and the amount of hardening trash was 34 % of the weight.
The multi-transfer-molding system which used the tablet currently carried out from the former performed closure shaping of a semi-conductor in molding cycle 105 seconds using the same ingredient as example of comparison 1 example 1. Ingredient compressibility was 92 - 94%, and moreover the weld flash elongation of the non-filling part and tie rod section and an internal void were not accepted, the wire sweep was 5% or less, and the amount of hardening trash was 42 % of the weight. [ mold goods / 50 ] [ the minute void ] The result of an example 1 and the example 1 of a comparison is shown in the 1st table.
[0022]
[Table 1]
第1表

| | 実施例1 | 比較例1 |
|---|---|---|
| 材料圧縮率（%） | 96～98 | 92～94 |
| 充填性 | 0／50 | 0／50 |
| バリ | 0／50 | 0／50 |
| 内部ボイド | 0／50 | 0／50 |
| 微小ボイド | 少 | 多数 |
| ワイヤスイープ（%） | ＜5 | ＜5 |
| 硬化廃棄物（重量%） | 34 | 42 |
| 成形サイクル（秒） | 87 | 105 |

[0023] Although the example 1 fabricated using this invention approach and equipment do not have a difference about restoration nature , weld flash , an internal void , and a wire sweep compared with the

example 1 of a comparison by the conventional multi-transfer molding , its ingredient compressibility be high and the minute void be excellent in few points , so that it may see in the 1st table . Moreover, since a molding cycle is short and there are few rates of hardening trash, it turns out that it excels also in productivity and economical efficiency.

[0024]

[Effect of the Invention] According to the semi-conductor closure shaping approach and equipment of this invention, an injection unit is used. Supply the epoxy resin closure ingredient of powdered in from supply of an epoxy resin closure ingredient to shaping, or granularity, knead [ homogeneity ] and fuse by the screw device, and since it injects Fluid improvement the size enlargement of a tablet like the conventional transfer molding is unnecessary, and according to the viscosity down of an epoxy resin closure ingredient, Reduction of hardening trash is possible and semi-conductor closure shaping which was further excellent in productivity and quality sides, such as cycle compaction by compaction of the setting time, an injection time, and the preheating time and reduction of a minute void, can be performed. Moreover, by having examined the part which throws in a screw configuration and the ingredient of powdered or granularity, without being caught by the conventional concept, homogeneity kneading and melting were able to become possible and the semi-conductor closure shaping approach and equipment excellent in continuous-molding nature were able to be obtained. With the shaping equipment of a vertical-type bundle and ******, the overall height was also set to 3,000mm or less, and the installation of it into an ordinary clean room was attained. Even if it compares with the injection molding machine of common thermoplastics or thermosetting resin, it is reduced sharply and injection unit length can contribute to space-saving-ization greatly.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

## TECHNICAL FIELD

---

[Field of the Invention] This invention relates to the semi-conductor closure shaping approach and equipment. This invention excels [ molding cycle ] in productivity short in more detail, it is useful to operation of the semi-conductor closure shaping approach with few [ there are few amounts of hardening trash and ] minute voids in the hardened epoxy resin closure ingredient, and this shaping approach, and, moreover, installation into the ordinary clean room where an overall height is low is related with easy semi-conductor closure shaping equipment.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

PRIOR ART

---

[Description of the Prior Art] Transfer molding of an epoxy resin closure ingredient is conventionally used for the closure of IC, LSI, and the semi-conductor of discrete ** as an approach suitable for low cost, high-reliability, and productivity. Supplying to the pot in metal mold and carrying out heating melting to it, it transports into a metal mold cavity and is made to harden by pressurizing with a plunger in transfer molding, after carrying out size enlargement of the epoxy resin closure ingredient to the shape of a tablet.
[0003] However, since it will be the requisite to carry out size enlargement of the epoxy resin closure ingredient to the shape of a tablet, the process of size enlargement is required of this shaping approach. Since various configurations of a required tablet change with the configuration and magnitude of the semiconductor package fabricated, much metal mold for size enlargement is also need. Moreover, for every shaping, since an injection of a tablet and thermofusion are required, a molding cycle cannot be shortened below to fixed time amount. furthermore, in order that the runner section which be passage until the epoxy resin closure ingredient fed into the pot flow the inside of metal mold and reach in a cavity, and the cull section remaining within a pot may harden completely, there be a problem of a lot of hardening trash in addition to the semiconductor package section to need be generate, and a limitation be in low cost-izing and high-volume production capability from these points.
[0004] On the other hand, examination of an injection-molding system has been conventionally performed as the shaping approach of the thermosetting resin molding material containing an epoxy resin. In injection molding, it is supplied in granularity, and it is injected [ that an epoxy resin molding compound is powdered in an injection molding machine, or ] by metal mold on a screw, maintaining a melting condition within a cylinder. For this reason, the process which carries out size enlargement to the shape of a tablet is unnecessary, and the equipment and time amount for size enlargement can be omitted. Moreover, in order to inject in the state of melting, there is no constraint of the diameter of a tablet and weight like transfer molding, and it can apply to various semiconductor packages easily. Furthermore, it is an approach suitable for mass production method that it can produce continuously, and the setting time is shortened compared with transfer molding, and the runner section and the sprue section which are passage can be lessened since it will be in a homogeneity melting condition and the hypoviscosity-ized molding material is injected by metal mold etc.
[0005] However, injection molding was not conventionally put in practical use as the shaping approach of an epoxy resin closure ingredient. As the reason, the conventional epoxy resin closure ingredient is because the thermal stability of the epoxy resin closure ingredient which viscosity increases, has the property to lose a fluidity in 5 - 10 minutes, and was fused by advance of the hardening reaction of the resin in an epoxy resin closure ingredient in the state of melting within the cylinder heated by 70-110 degrees C is remarkable and low. For this reason, injection molding in low voltage is impossible, injection molding in high pressure was needed, and, as a result, the electric performance degradation by the pressurization to an internal component etc. resulted in spoiling the dependability of the semiconductor package obtained remarkably for deformation of the bonding wire on a semi-conductor, cutting, or diode. Moreover, when fixed time amount interruption of the shaping was carried out for

cleaning of metal mold etc., since it hardened within a cylinder and injection for the second time became impossible, the epoxy resin closure ingredient also had the problem of causing trouble also in the mass production.

[0006] Although the screw configuration in the injection unit of a thermosetting resin injection molding machine changes variously with each making machine manufacturers, more generally than relation, such as a configuration of uniform plasticization melting and the temperature control zone of a cylinder, balance of die length, and a measuring stroke, the ratio (ratio of length to diameter) of the screw effective length L and the diameter D of a screw is ratio-of-length-to-diameter=14-18. For this reason, as for the dimension of the metal mold which injects and stiffens an ingredient in a cavity, and the whole equipment including the mold clamp device which opens and closes that metal mold, it is common to exceed 3,000mm as an overall height of a vertical-type bundle and ******. In ******, a shaping manufacturer's head-lining height has many cases of the blow by to the second floor. however, in semi-conductor shaping, an environment thinks as important from a viewpoint of protection of a semi-conductor -- having -- constant temperature -- since - constant humidity and clean-ization are called for, it is an all-rooms clean room. Therefore, the installation tooth space of shaping equipment has constraint, and all the overall heights of transfer-molding equipment have become 3,000mm or less. Especially in the case of injection-molding equipment, the overall height of shaping equipment became high with the die length of an injection unit, and the problem that it could not install in a clean room had arisen.

[0007] In the case of common thermosetting resin, the configuration of the injection unit from a closure ingredient injection to injection is classified into the cylinder installation section which has a cylinder and a water-cooled circuit. The quality of the material of the cylinder installation section has many castings, and the surface roughness of ingredient input port which performed simple machining is usually 50-100micromRa, and even if it finish-machines, it is 12.5-25micromRa. The quality of the material of a cylinder has much heat-treated special steel material, and the surface roughness of the ingredient style admission into a club prepared in the cylinder is 3.2-25micromRa. Moreover, in the connection of input port and the inflow section, the level difference has arisen in many cases. Although it is such surface roughness, and it will be hard to generate a problem to the fluidity in an ingredient injection part when it is the pellet type molding compound of thermoplastics if the level difference has arisen at the time of assembly, in the case of powdered or the epoxy resin closure ingredient supplied by granularity, a fluidity is bad, a bridge is generated in input port and the inflow section, and measuring variation and the problem of an ingredient not being supplied if it pulls tend to occur.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

## EFFECT OF THE INVENTION

---

[Effect of the Invention] According to the semi-conductor closure shaping approach and equipment of this invention, an injection unit is used. Supply the epoxy resin closure ingredient of powdered in from supply of an epoxy resin closure ingredient to shaping, or granularity, knead [ homogeneity ] and fuse by the screw device, and since it injects Fluid improvement the size enlargement of a tablet like the conventional transfer molding is unnecessary, and according to the viscosity down of an epoxy resin closure ingredient, Reduction of hardening trash is possible and semi-conductor closure shaping which was further excellent in productivity and quality sides, such as cycle compaction by compaction of the setting time, an injection time, and the preheating time and reduction of a minute void, can be performed. Moreover, by having examined the part which throws in a screw configuration and the ingredient of powdered or granularity, without being caught by the conventional concept, homogeneity kneading and melting were able to become possible and the semi-conductor closure shaping approach and equipment excellent in continuous-molding nature were able to be obtained. With the shaping equipment of a vertical-type bundle and ******, the overall height was also set to 3,000mm or less, and the installation of it into an ordinary clean room was attained. Even if it compares with the injection molding machine of common thermoplastics or thermosetting resin, it is reduced sharply and injection unit length can contribute to space-saving-ization greatly.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

TECHNICAL PROBLEM

---

[Problem(s) to be Solved by the Invention] This invention excels [ molding cycle ] in productivity short, it is useful to operation of the semi-conductor closure shaping approach with few [ there are few amounts of hardening trash and ] minute voids in the hardened epoxy resin closure ingredient, and this shaping approach, and, moreover, installation into the ordinary clean room where an overall height is low is made for the purpose of offering easy semi-conductor closure shaping equipment.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

MEANS

---

[Means for Solving the Problem] this invention persons by using the screw whose ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw are 8-12 as an injection unit, as a result of repeating research wholeheartedly that the above-mentioned technical problem should be solved Closure shaping by the epoxy resin closure ingredient of powdered or granularity can be performed smoothly. Furthermore, by setting screw effective length to 250-400mm, setting the ingredient input port in an injection unit, and surface roughness of the inflow section to 0.40-6.3micromRa, and considering as the configuration which does not have a level difference in input port and the connection part of the inflow section It finds out that closure shaping can be performed much more efficiently, and came to complete this invention based on this knowledge. Namely, this invention fixes as an insertion the lead wire to which (1) semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and sets it to the shaping approach which closes this with an epoxy resin closure ingredient. The epoxy resin closure ingredient of powdered or granularity is supplied to an injection unit. It is the semi-conductor closure shaping approach which closes a semi-conductor by homogeneity-kneading, fusing by the screw device, injecting in a cavity with a screw or a plunger, and stiffening said injected closure ingredient. As an injection unit The semi-conductor closure shaping approach characterized by using the screw whose ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw are 8-12, (2) In the shaping equipment which fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient Supply the epoxy resin closure ingredient of powdered or granularity, and by the screw device, homogeneity-knead and it fuses. It has the injection unit injected in a cavity with a screw or a plunger. It is semi-conductor closure shaping equipment which closes a semi-conductor by stiffening said injected closure ingredient. The semi-conductor closure shaping equipment with which the screw in an injection unit is characterized by the ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw being 8-12, (3) In the semi-conductor closure shaping equipment given in ** (2) term the given screw effective length L is 250-400mm, and the ingredient injection section in (4) injection units The semi-conductor closure shaping equipment given in ** (2) term which each surface roughness of input port and the inflow section is 0.40-6.3micromRa, and is the configuration which does not have a level difference in the connection of input port and the inflow section is offered.
[0010]
[Embodiment of the Invention] In the shaping approach which the semi-conductor closure shaping approach of this invention fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient The epoxy resin closure ingredient of powdered or granularity is supplied to an injection unit. It is the semi-conductor closure shaping approach which closes a semi-conductor by homogeneity-kneading, fusing by the screw device, injecting in a cavity with a screw or a plunger, and stiffening said injected closure ingredient. As an injection unit The ratio (ratio of length to

diameter) of the screw effective length L and the diameter D of a screw uses the screw which are 8-12. In the shaping equipment which the semi-conductor closure shaping equipment of this invention fixes as an insertion the lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and closes this with an epoxy resin closure ingredient Supply the epoxy resin closure ingredient of powdered or granularity, and by the screw device, homogeneity-knead and it fuses. It has the injection unit injected in a cavity with a screw or a plunger. By stiffening said injected closure ingredient, it is semi-conductor closure shaping equipment which closes a semi-conductor, and the screw in an injection unit is [ the ratios (ratio of length to diameter) of the screw effective length L and the diameter D of a screw ] 8-12.

[0011] The semi-conductor closure shaping equipment of drawing 1 of this invention is an outline front view [ like ] 1 voice, drawing 2 is the outline top view of the shaping important section, and drawing 3 is the important section sectional view of the injection unit. the voice shown in drawing 1 -- the shaping equipment with which it is joined and, as for semi-conductor closure shaping equipment [ like ], a semi-conductor closes the leadframe by which wirebonding was carried out -- it is -- an injection unit 1 and a screw -- complete -- it has 2, a mechanical component 3, the shaping metal mold 4, and the mold clamp unit 5. As shown in drawing 1 and drawing 2 , the shaping important section A semi-conductor is joined and the leadframe by which wirebonding was carried out is contained. The in magazine 6 transported to degree process, the frame shooter 7 which conveys the transported leadframe to alignment and metal mold, powdered or the injection unit 1 which kneads and fuses the epoxy resin closure ingredient supplied by granularity, and injects it in a cavity, and a leadframe are considered as an insertion. A semi-conductor The shaping metal mold 4 and shaping metal mold which carry out closure shaping It consists of out cassettes 10 which convey and accumulate the mold clamp unit 5 opened and closed, the cleaning unit 8 which cleans the cavity front face of shaping metal mold, the fabricated leadframe, and the gate break 9 which separates the runner gate and the fabricated leadframe. It is substantially [ as the shaping equipment which also shows the shaping equipment which closes the lead wire to which the semi-conductor was joined to drawing 1 ] the same.

[0012] this invention equipment -- setting -- the screw of an injection unit 1 -- complete -- 2 has a configuration as shown in drawing 3 . That is, it has a cylinder 11, the nozzle tip 12 connected with a screw, the temperature control jacket 13 which performs temperature control of a cylinder, the screw 14 which performs migration, kneading, and melting of an epoxy resin closure ingredient, and the cylinder installation section 15 which has a water-cooled circuit, and the ingredient style admission into a club 17 is formed in ingredient input port 16 and a cylinder at the cylinder installation section. The epoxy resin closure ingredient of powdered or granularity is thrown in from ingredient input port 16, and is supplied in a cylinder 11 via the ingredient style admission into a club 17. A screw 14 retreats rotating, performs ingredient measuring of the specified quantity, and transports an ingredient to the front. At this time, plasticization kneading and melting compressing, it is transported to the front and an epoxy resin closure ingredient is accumulated in a nozzle tip 12 in the condition of having been hypoviscosity-ized by the internal-friction heat by screw rotation, and the heat tracing from the temperature control jacket 13. Then, after being injected in a cavity and passing through the predetermined setting time by advance of a screw 14, closure shaping of a semi-conductor is completed a mold aperture and by carrying out ejection. [0013] As for the epoxy resin closure ingredient used in this invention approach, it is desirable that it is what contains an epoxy resin, a phenol resin system curing agent, a hardening accelerator, and a minerals filler as an indispensable component, and it is shown in JP,8-67741,A, JP,8-67742,A, and JP,8-67745,A, and the configuration is powdered or granularity and does not have to carry out size enlargement of the presentation to a tablet like [ in transfer molding ]. And the thermal stability within the cylinder of an injection unit is good, within a cavity, especially a fluidity is good and it is desirable that it is what is hardened promptly.

[0014] There is especially no limit in the injection unit used in this invention, for example, a screw in-line type, a plunger type, a screw plunger ceremony, etc. can be held. In these, the injection unit of a screw in-line type can be used especially suitably. The process in an injection unit until it results [ from ingredient supply ] in injection serves as ingredient supply, measuring, kneading, compression, melting,

and injection, and when kneading, the compression, and the fusion zone which is especially a plasticization part are screw in-line types, it can lessen the void to which importance is attached most in closure shaping of a semi-conductor. By applying a fixed pressure to the epoxy resin closure ingredient which was extruded ahead [ injection unit ] on the screw and was measured, a screw retreats rotating and plasticization and homogeneity kneading of an ingredient are performed in that case. Furthermore, the volatile matter and air which are included in resin can be missed to an ingredient input port side by adjusting this pressure pressurized from the backside [ a screw ]. Moreover, although injection after melting can use a screw, a plunger, etc., it is desirable that it is a screw in-line type from points, such as simplicity of structure, an ease of handling, and space-saving-izing of an injection unit. It compares with the preheating which used the RF pre-heater of the tablet which is a plasticization process in transfer molding of the conventional method in this invention approach since the injection unit was used, and the preheating within a metal mold pot. It excels in homogeneity melting nature and reduction of the hardening trash by little-izing of the sprue which is the fluid improvement and the passage of an ingredient accompanying the fall of resin viscosity, a runner, etc., compaction of the setting time, etc. are excellent in respect of improvement in the quality represented by the improvement in productivity, and reduction of a void.

[0015] The shaping metal mold for conventional transfer-molding equipment considering as an insertion lead wire to which the semi-conductor was joined and the leadframe or semi-conductor by which wirebonding was carried out was joined, and carrying out closure shaping, The mold clamp unit for opening and closing shaping metal mold, the tablet feeder which supplies an ingredient, The in loader unit which performs accumulation, alignment, and conveyance of the plunger style which pressurizes a tablet, a leadframe or lead wire, and a tablet, It is common to consist of unloaders which convey and accumulate the leadframe or lead wire after the cleaning unit which cleans the weld flash, dirt, etc. of a metal mold parting plane, the gate break unit which performs separation of mold goods with the ejection and the cull runner of a moldings, and separation. The semi-conductor closure shaping equipment of this invention supplies the epoxy resin closure ingredient of powdered or granularity by ingredient feeders , such as an air transport method and a cassette system , instead of a tablet feeder in the conventional transfer-molding system , and consists of injection units which inject an ingredient in the condition of having carry out homogeneity kneading and having fuse further instead of the plunger style which carries out preheating of the tablet and transports it into a cavity .

[0016] According to the semi-conductor closure shaping equipment of this invention, the gestalt from supply of an epoxy resin closure ingredient to shaping is powdered or granularity, with an injection unit, supply an epoxy resin closure ingredient, and it kneads [ homogeneity ] and fuses by the screw device, and since it injects, the size enlargement of a tablet is unnecessary and becomes reducible [ the fluid improvement in an ingredient, or hardening trash ]. Furthermore, it excels in improvement in productivity and quality, such as compaction of the setting time, and reduction of a void.

[0017] In the semi-conductor closure shaping equipment of this invention, sprue loess metal mold can be used as metal mold. That is, after taking out mold goods by controlling the temperature of the sprue section of metal mold to temperature a little lower than the temperature from which hardening of an epoxy resin closure ingredient cannot take place easily, i.e., the temperature to which equivalent [ to the temperature in a cylinder / almost ] or hardening advances depending on the melt viscosity of an epoxy resin closure ingredient, the epoxy resin closure ingredient which is not hardened [ of the sprue section ] can be injected and fabricated in the following cycle into a cavity. By carrying out this method, the amount of hardening trash can be further reduced greatly from the usual shaping method.

[0018] this invention equipment -- setting -- the screw in an injection unit -- the ratio (ratio of length to diameter) of the screw effective length L and the diameter D of a screw -- 8-12 -- it is -- more -- being desirable (ratio of length to diameter) -- it is 9-11. It is determined by the melting property of the epoxy resin closure ingredient fabricated among the functions of the injection unit required of a plasticization process, the plasticization engine performance, i.e., the screw configuration, of a screw. Generally, there is a compression ratio which are the effective length L of a screw, the ratio (ratio of length to diameter) of the diameter D of a screw, the screw slot pitch P of a screw and the ratio (P/D) of the diameter D of a

screw, and a ratio of the screw groove surface product of the ingredient feed zone of a screw and the screw groove surface product of a metering zone as a description of a configuration of judging this engine performance. In this invention equipment, there is especially no limit about the screw in an injection unit, and (P/D) a compression ratio, and suppose that it is equivalent to the screw of a common thermosetting resin injection molding machine. Plasticizing capacity [ as opposed to / that (ratio of length to diameter) is less than eight / an epoxy resin closure ingredient ] is insufficient, and there is a possibility that melting of a closure ingredient may become uneven. When (ratio of length to diameter) exceeds 12, there is a possibility that the overall height of shaping equipment may become high too much.

[0019] If the ratio (ratio of length to diameter) of the screw effective length L and the diameter D of a screw is large and the die length of an ingredient feed zone is large, plasticizing capacity is high, and since a kneading condition also improves, it is usually (ratio of length to diameter) set about to 14 to 18. When (ratio of length to diameter) is too small, screw die length required for plasticization of an ingredient is short, and when a screw retreats, the physical relationship of the screw to the temperature control zone of a cylinder always changes, and it is easy to generate melting temperature variation and the variation of a kneading condition, although it retreats while a screw rotates, and plasticization of an ingredient is performed in the phase of measuring of an ingredient. In this invention equipment, the screw effective length L becomes possible [ shortening ] by making (ratio of length to diameter) smaller than 8-12, and the former. In this invention equipment, as for the screw effective length L, it is desirable that it is 250-400mm, and it is more desirable that it is 280-350mm. Installation into an ordinary clean room is attained using the height of the whole shaping equipment as 3,000mm or less maintaining sufficient plasticizing capacity over an epoxy resin closure ingredient by setting screw effective length L to 250-400mm.

[0020] In the semi-conductor closure shaping equipment of this invention, it is desirable that each surface roughness of the input port in the ingredient injection section in an injection unit and the inflow section is 0.40-6.3micromRa, and it is more desirable that it is 1.60-4.0micromRa. Moreover, it is desirable that it is the configuration which does not have a level difference in the connection of input port and the inflow section. The cylinder configuration of the injection unit section is classified into the cylinder installation section and the cylinder which have a water-cooled circuit, as shown in drawing 3 , ingredient input port 16 is formed in the cylinder installation section which has a water-cooled circuit, and the ingredient style admission into a club 17 is formed in the cylinder. The epoxy resin closure ingredient of powdered or granularity is thrown in from ingredient input port by air transport, a cassette, etc. Although it is desirable that it is larger than the angle of repose whose wall surface of input port is the index of the flowability of the epoxy resin closure ingredient of that a horizontal plane and the include angle to make are powdered or granularity, it is difficult to consider as a larger include angle than an angle of repose from the physical relationship of the cylinder installation section and the drive section of an injection unit in many cases, and it is usually about 45 degrees. At an include angle of this level, since the epoxy resin closure ingredient of powdered or granularity has the bad fluidity, the bridge of an ingredient is generated in input port or the inflow section, as it is, the general surface roughness in the ingredient injection section, i.e., 3.2-100micromRa, of a thermoplastics making machine, problems, such as measuring variation, variation of measuring time amount, and ingredient short supply, occur, and there is a possibility that continuous running may become difficult. In this invention equipment, surface roughness of input port and the inflow section is set to 0.40-6.3micromRa. By considering as the configuration which processes into 1.6-6.3micromRa the inflow section of the cylinder installation section which has especially a water-cooled circuit, and does not have a level difference in the connection of input port and the inflow section Generating of the bridge of an epoxy resin closure ingredient is prevented, and closure shaping excellent in the continuation supply nature and continuation productivity of an ingredient of powdered or granularity is attained. If the surface roughness of input port and the inflow section is 0.40micromRa, it is usually unnecessary for it to fully be stabilized, to be able to supply the epoxy resin closure ingredient of powdered or granularity, and to make surface roughness under into 0.40micromRa, and it is only that processing cost becomes high in vain. When the

surface roughness of input port and the inflow section exceeds 6.3micromRa, a bridge is generated into the epoxy resin closure ingredient of powdered or granularity, and there is a possibility that supply may become unstable.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

EXAMPLE

---

[Example] Although an example is given to below and this invention is further explained to it at a detail, this invention is not limited at all by these examples. In addition, in the example and the example of a comparison, evaluation of closure mold goods etc. was performed by the following approach.
(1) With an ingredient compressibility underwater substitution method, measure a tablet in transfer molding, measure the apparent specific gravity of a injection object with injection molding, and % shows the ratio to the true specific gravity of a hardened material (mold goods). That ingredient compressibility is small has the small compression ratio of the fabricated tablet or an injection-molded product, and it means that many minute voids are included in mold goods, including air etc. mostly.
(2) Observe the existence of a surface non-filling part about 50 restoration nature mold goods using a stereoscopic microscope 10 times the scale factor of this.
(3) Observe weld flash elongation extent of the tie rod section of a leadframe about 50 weld flash mold goods.
(4) About 50 internal void mold goods, irradiate a supersonic wave and observe the internal void of magnitude with a diameter of 0.5mm or more.
(5) Observe extent of the numerousness of the voids of the fracture surface of the field where IC component is joined using an electron microscope 1,000 times the very small void scale factor of this.
(6) irradiate soft X ray at wire sweep mold goods, measure the amount of flow (deformation) of a bonding wire (the diameter of 30 micrometers, and die length of 3.2mm -- semi -- hard -- a gold streak), and % shows the ratio of the amount of the maximum wire deformation to the distance between the bondings of IC component end face and a lead terminal.
(7) The amount of trash of hardening trash cull and sprue, and the runner section shows the rate of occupying into all closure ingredients, by weight %.
Closure shaping of the semi-conductor by the epoxy resin closure ingredient was performed using the semi-conductor closure shaping equipment of this invention shown in example 1 drawing 1 , drawing 2 , and drawing 3 . 300mm and the diameter D of a screw are 30mm, and (ratio of length to diameter of the effective length L of the screw of an injection unit) is 10. Moreover, in the ingredient injection section, each surface roughness of input port and the inflow section is 3.2micromRa. as an epoxy resin closure ingredient -- Sumi Cong by Sumitomo Bakelite Co., Ltd. -- "EME-J001" was used. It was set as the cylinder laying temperature of 83 degrees C, injection-pressure 1,300 kgf/cm2, the injection speed of 5-10mm/second, and the die temperature of 180 degrees C, and sprue loess shaping was performed. Metal mold is eight cavities / one frame, and was made into 32-piece picking of four frames. IC component (64pQFP) -- joining -- a gold streak -- the copper leadframe by which bonding was carried out was set to metal mold, and full automatic shaping was carried out in molding cycle 87 seconds. It evaluated about the epoxy resin closure ingredient injected from the injection unit, and the mold goods by which the closure was carried out. Ingredient compressibility was 96 - 98%, moreover the weld flash elongation of the non-filling part and tie rod section and an internal void were not accepted about 50 mold goods, there were few minute voids, the wire sweep was 5% or less, and the amount of hardening trash was 34 % of the weight.

The multi-transfer-molding system which used the tablet currently carried out from the former performed closure shaping of a semi-conductor in molding cycle 105 seconds using the same ingredient as example of comparison 1 example 1. Ingredient compressibility was 92 - 94%, and moreover the weld flash elongation of the non-filling part and tie rod section and an internal void were not accepted, the wire sweep was 5% or less, and the amount of hardening trash was 42 % of the weight. [ mold goods / 50 ] [ the minute void ] The result of an example 1 and the example 1 of a comparison is shown in the 1st table.

[0022]

[Table 1]

第1表

| | 実施例1 | 比較例1 |
|---|---|---|
| 材料圧縮率（%） | 96～98 | 92～94 |
| 充填性 | 0／50 | 0／50 |
| バリ | 0／50 | 0／50 |
| 内部ボイド | 0／50 | 0／50 |
| 微小ボイド | 少 | 多数 |
| ワイヤスイープ（%） | ＜5 | ＜5 |
| 硬化廃棄物（重量%） | 34 | 42 |
| 成形サイクル（秒） | 87 | 105 |

[0023] Although the example 1 fabricated using this invention approach and equipment do not have a difference about restoration nature , weld flash , an internal void , and a wire sweep compared with the example 1 of a comparison by the conventional multi-transfer molding , its ingredient compressibility be high and the minute void be excellent in few points , so that it may see in the 1st table . Moreover, since a molding cycle is short and there are few rates of hardening trash, it turns out that it excels also in productivity and economical efficiency.

---

[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

## DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is the outline front view of one mode of the semi-conductor closure shaping equipment of this invention.
[Drawing 2] Drawing 2 is the outline top view of the shaping important section of the shaping equipment shown in drawing 1 .
[Drawing 3] Drawing 3 is the important section sectional view of the injection unit section of the shaping equipment shown in drawing 1 .
[Description of Notations]
1 Injection Unit
2 Screw -- Complete
3 Mechanical Component
4 Shaping Metal Mold
5 Mold Clamp Unit
6 In Magazine
7 Frame Shooter
8 Cleaning Unit
9 Gate Break
10 Out Cassette
11 Cylinder
12 Nozzle Tip
13 Temperature Control Jacket
14 Screw
15 Cylinder Installation Section
16 Ingredient Input Port
17 Ingredient Style Admission into a Club

---

[Translation done.]

* NOTICES *



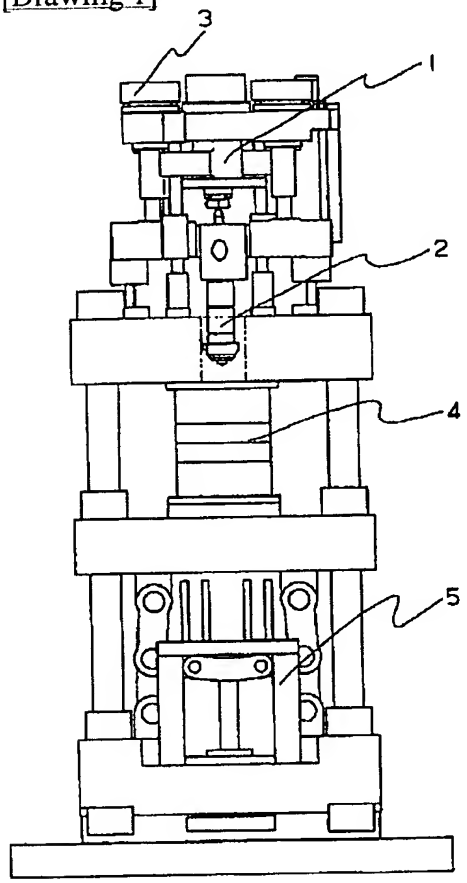
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

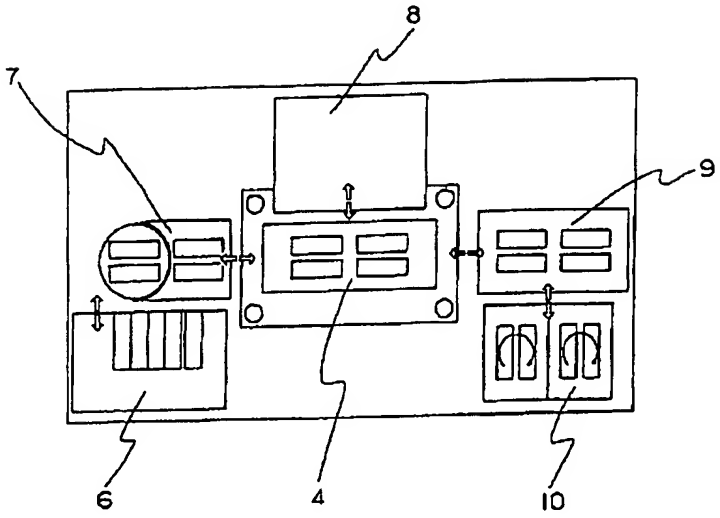
DRAWINGS

---

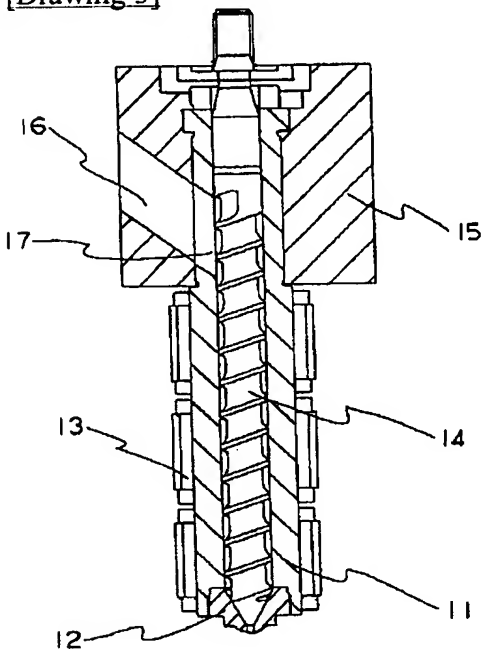
[Drawing 1]




[Drawing 2]




[Drawing 3]




---

[Translation done.]